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(11)

EP 1 340 914 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
05.11.2003 Bulletin 2003/45

(51) Int Cl.7: **F04C 2/10**

(43) Date of publication A2:
03.09.2003 Bulletin 2003/36

(21) Application number: **03004252.7**(22) Date of filing: **26.02.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

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(30) Priority: **01.03.2002 JP 2002056476**
01.03.2002 JP 2002056478

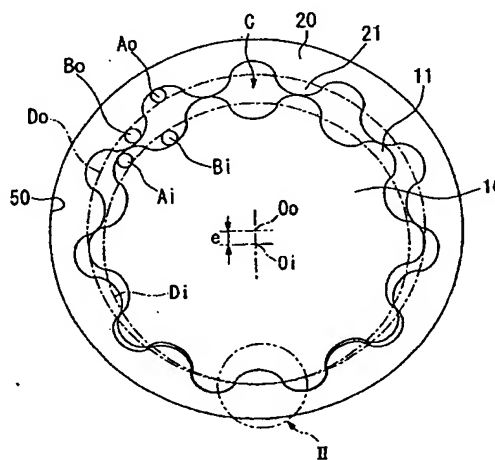
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(54) Internal gear oil pump

(57) An oil pump emits less noise by properly forming the profiles of teeth of an inner rotor and an outer rotor thereof which engage each other, whereby decreasing sliding resistance and rattle between the tooth surfaces of the rotors. The rotors (10, 20) of the oil pump are formed in such a manner that the inner rotor (10) having "n" teeth is formed such that the tooth tip profile and tooth space profile thereof are formed using cycloid curves which are formed by rolling a first circumscribed-rolling circle (Ai) and a first inscribed-rolling circle (Bi) along a base circle (Di), respectively, and the outer rotor (20) having "n+1" teeth is formed such that the tooth tip profile and tooth space profile thereof are formed using cycloid curves which are formed by rolling a second circumscribed-rolling circle (Ao) and a second inscribed-rolling circle (Bo) along a base circle (Do), respectively, and in such a manner that the following equations are satisfied: $\phi Bo = \phi Bi$; $\phi Do = \phi Di \cdot (n+1)/n + t \cdot (n+1)/(n+2)$; and $\phi Ao = \phi Ai + t/(n+2)$, where ϕDi , ϕAi , ϕBi , ϕDo , ϕAo , and ϕBo are the diameters of the base circle of the inner rotor (10), of the first circumscribed-rolling circle (Ai), of the first inscribed-rolling circle (Bi), of the base circle of the outer rotor (20), of the second circumscribed-rolling circle (Ao), of the second inscribed-rolling circle (Bo), respectively, and t ($\neq 0$) is gap between the tooth tip of the inner rotor (10) and the tooth tip of the outer rotor (20).

FIG. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 03 00 4252

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IntCl.7)
A	US 5 135 373 A (COZENS ERIC) 4 August 1992 (1992-08-04) * claims 1-3 *	1,3	F04C2/10
A	EP 0 870 926 A (MITSUBISHI MATERIALS CORP) 14 October 1998 (1998-10-14) * claim 1 *	1,3	
A	EP 1 016 784 A (SUMITOMO ELECTRIC INDUSTRIES) 5 July 2000 (2000-07-05) * claim 1 *	1,3	
A	EP 0 552 443 A (EISENMANN SIEGFRIED A) 28 July 1993 (1993-07-28) * claim 1 *	1,3	
A	EP 0 779 432 A (MITSUBISHI MATERIALS CORP) 18 June 1997 (1997-06-18) * claim 1 *	1,3	
A	EP 0 785 360 A (MITSUBISHI MATERIALS CORP) 23 July 1997 (1997-07-23) * claim 1 *	1,3	TECHNICAL FIELDS SEARCHED (IntCl.7) F04C
A	RYAZANTSEV V M: "CYCLOIDAL GENERATING GEARS OF THE WORKING ELEMENTS OF POSITIVE-DISPLACEMENT ROTOR MACHINES AND THEIR ENGAGEMENT FACTORS" SOVIET ENGINEERING RESEARCH. (STANKI I INSTRUMENTY & VESTNIK MASHINOSTROENIA MASHINOSTROENIE), ALLERTON PRESS, NEW YORK, US, vol. 11, no. 9, 1991, pages 16-21, XP000291913		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 September 2003	Examiner Dimitroulas, P
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document</p> <p>T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 00 4252

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15-09-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5135373	A	04-08-1992	NONE	
EP 0870926	A	14-10-1998	DE 69816163 D1 EP 0870926 A1 JP 11264381 A US 6077059 A	14-08-2003 14-10-1998 28-09-1999 20-06-2000
EP 1016784	A	05-07-2000	EP 1016784 A1 US 6244843 B1 DE 29824515 U1 WO 9911935 A1 JP 2003056473 A	05-07-2000 12-06-2001 10-05-2001 11-03-1999 26-02-2003
EP 0552443	A	28-07-1993	DE 4200883 C1 DE 59203844 D1 EP 0552443 A1 JP 2818723 B2 JP 5256268 A KR 150804 B1 US 5368455 A	15-04-1993 02-11-1995 28-07-1993 30-10-1998 05-10-1993 02-11-1998 29-11-1994
EP 0779432	A	18-06-1997	JP 9166091 A DE 69607927 D1 DE 69607927 T2 EP 0779432 A1 US 5813844 A JP 3293505 B2 JP 9256963 A JP 3293506 B2 JP 9256964 A	24-06-1997 31-05-2000 05-10-2000 18-06-1997 29-09-1998 17-06-2002 30-09-1997 17-06-2002 30-09-1997
EP 0785360	A	23-07-1997	DE 69702776 D1 DE 69702776 T2 EP 0785360 A1 JP 3293507 B2 JP 9256965 A US 5876193 A	21-09-2000 01-02-2001 23-07-1997 17-06-2002 30-09-1997 02-03-1999

EPO FORM P443

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82